CLAIMS

1. A cellular radio communication system for transmitting blocks of data over transmission links, comprising:

a data storage means for storing sets of modulation scheme and forward error correction coding level pairs which give an optimum data rate at a predetermined bit error rate and a predetermined symbol rate for different quality transmission links;

means for monitoring the quality of a transmission link;

means for interrogating the database and allocating a modulation scheme and forward error correction coding level pair to the blocks of data transmitted over a transmission link dependent on the monitored quality of the transmission link; and

means for applying the allocated modulation scheme and forward error correction coding level to the blocks of data.

2. A cellular radio communication system according to claim 1 wherein the modulation scheme can be selected from 64-QAM, 16-QAM and QPSK.

3. A cellular radio communication system according to claim 1 wherein the forward error correction coding used is a BCH forward error correction code.

4. A cellular communication system according to claim 1 wherein the transmission links are links between a plurality of end user terminals located within a cell and a base station located within the cell.

5. A cellular communication system according to claim 1 wherein the system comprises means for storing a default modulation scheme

suitable for the or each transmission link in poor environmental conditions for use when a call is initiated over the transmission link.

6. A cellular communication system according to claim 1 wherein the transmission links are links between a plurality of end user terminals located within a cell and a base station located within the cell and the system comprises means for storing a default modulation scheme for each end user terminal dependent on the distance between the end user terminal and the base station for use when a call is initiated over the transmission link.

7. A cellular communication system according to claim 1 wherein the transmission links are links between a plurality of end user terminals located within a cell and a base station located within the cell and the system comprises means for adjusting the power of the transmission links dependent on the level of traffic over the transmission links while maintaining the predetermined bit error rate.

8. A cellular communication system according to claim 1 wherein the transmission links are links between a plurality of end user terminals located within a cell and a base station located within the cell and the system comprises means for increasing the level of forward error correction coding allocated to the transmission links so as to use the bandwidth of the transmission links and means for adjusting the power of the transmission links dependent on the change in the level of forward error correction coding to maintain the predetermined bit error rate.

9. A cellular communication system according to claim 1 wherein the transmission links are links between a plurality of end user terminals located within a cell and a base station located within the cell and the

transmission links from the end user terminals to the base station comprise a common medium access uplink.

10. A cellular communication system according to claim 1 wherein the transmission links are links between a plurality of end user terminals located within a cell and a base station located within the cell and the transmission links from the base station to the end user terminals comprise a broadcast downlink.

11. A cellular communication system according to claim 1 wherein a block of data comprises a header and a payload and the system comprises means for storing a default modulation scheme suitable for the or each transmission link in poor environmental conditions and the means for allocating a modulation scheme to the blocks of data transmitted over the transmission link allocates the default modulation scheme to the headers of the blocks of data.

12. A cellular communication system according to claim 1 wherein the transmission link is between a transmitting unit and a receiving unit and the receiving unit comprises:

means for monitoring the quality of the transmission link; and means for communicating the quality of the transmission link to the transmitting unit; and

the transmitting unit comprises:

means for interrogating the database and allocating a modulation scheme and forward error correction coding pair depending on the quality of the transmission link.

13. A base station for transmitting blocks of data over a plurality of transmission links to a plurality of end user terminals, comprising:

a data storage means for storing sets of modulation scheme and forward error correction level coding pairs

which generate an optimum data rate at a predetermined bit error rate and a predetermined symbol rate for different quality transmission links;

means for interrogating the database and allocating a modulation scheme and forward error correction coding pair to the blocks of data to be transmitted over each transmission link dependent on the quality of the transmission link; and

means for applying the allocated modulation scheme and forward error correction coding level to the blocks of data.

14. A base station according to claim 13 wherein the modulation scheme can be selected from 64-QAM, 16-QAM and QPSK.

15. A base station according to claim 13 wherein the forward error correction coding used is a BCH forward error correction code.

16. A base station according to claim 13 wherein the transmission links are links between a plurality of end user terminals located within a cell associated with the base station.

17. A base station according to claim 13 wherein the base station comprises means for storing a default modulation scheme for each transmission link to the end user terminals in poor environmental conditions for use when a call is initiated.

18. A base station according to claim 13 wherein the base station comprises means for storing a default modulation scheme for each end user terminal dependent on the distance between the end user terminal and the base station for use when a call is initiated.

19. A base station according to claim 13 wherein the base station comprises means for adjusting the power of the transmission links dependent on the level of traffic over the transmission links while maintaining the predetermined bit error rate.

20. A base station according to claim 13 wherein the base station comprises means for increasing the level of forward error correction coding allocated to the transmission links so as to use the bandwidth of the transmission links and means for adjusting the power of the transmission links dependent on the change in the level of forward error correction coding to maintain the predetermined bit error rate.

21. A base station according to claim 13 comprising means for measuring the quality of the transmission link from each end user terminals and means for transmitting to each end user terminal the modulation scheme and forward error coding level associated with the measured quality.

22. A base station according to claim 13 wherein the transmission links from the base station to the end user terminals comprise a broadcast downlink.

23. A base station according to claim 13 wherein a block of data comprises a header and a payload, the base station comprises means for storing a default modulation scheme for each transmission link in poor environmental conditions and the means for allocating a modulation scheme to the blocks of data transmitted over the transmission links allocates the default modulation scheme to the headers of the blocks of data.

24. A base station according to claim 13 wherein the base station comprises means for receiving signals from the end user terminals

representing the quality of the transmission links from the base station to the end user terminal.

25. An end user terminal for receiving and transmitting blocks of data over a transmission link to a base station, comprising:

means for applying a modulation scheme and forward error correction coding level to the blocks of data in accordance with instructions from the base station wherein the modulation scheme and forward error correction level generate an optimum data rate over the transmission link for a predetermined symbol rate and a predetermined bit error rate.

26. An end user terminal according to claim 25 wherein the modulation scheme can be is selected from 64-QAM, 16-QAM and QPSK.

27. An end user terminal according to claim 25 wherein the forward error correction coding used is a BCH forward error correction code.

28. An end user terminal according to claim 25 wherein a default modulation scheme is allocated to the end user terminal for use when a call is initiated.

29. An end user terminal according to claim 25 wherein a default modulation scheme is allocated to the end user terminal dependent on the distance between the end user terminal and the base station for use when a call is initiated.

30. An end user terminal according to claim 25 additionally comprising means for adjusting the power of the transmission link dependent on an instruction from the base station wherein the power is adjusted

dependent on the level of traffic over all transmission links to the base station while maintaining the predetermined bit error rate.

31. An end user terminal according to claim 25 comprising means for measuring the quality of the incoming transmission link and means for transmitting the measured quality to the base station.

32. An end user terminal according to claim 25 wherein the transmission link from the end user terminal to the base station comprises part of a common medium access uplink.

33. An end user terminal according to claim 25 wherein a block of data comprises a header and a payload, a default modulation scheme is allocated to the end user terminal by the base station and the means for applying a modulation scheme applies the default modulation scheme to the headers of the blocks of data.

34. A receiving unit for receiving signals from at least one transmission link, which signals carry blocks of data where each block comprises a payload and a header containing information about the modulation scheme applied to the payload wherein the receiving unit comprises:

a receiving antenna means;

a downconverter means for downconverting a radio frequency signal received by the antenna means to an intermediate frequency signal;

an IQ demodulator means for demodulating the intermediate frequency signal;

a recovery means for receiving the output of the IQ demodulator and for recovering the payload modulation scheme from each header;

an IQ signal detection block for receiving the output of the IQ demodulator, the IQ signal detection block comprising:

a first arm for detecting an IQ demodulated signal from a first modulation scheme;
a second arm for detecting an IQ demodulated signal from a second modulation scheme; and
switching means for switching the output from the IQ demodulator through one or the other of the arms dependent on the payload modulation scheme recovered by the recovery means.

35. A receiving unit according to claim 34 wherein the header contains information about a level of forward error correction applied to the payload and the recovery means comprises means for recovering the level of forward error correction from the header and the base station additionally comprises:

a forward error correction decoder for decoding the output from the IQ signal detection block in accordance with the coding level recovered from the header.

36. A receiving unit according to claim 34 additionally comprising means for receiving an output from the IQ signal detection block and measuring the vector error associated with a transmission link.

37. A receiving unit according to claim 34 additionally comprising means for receiving an output from the IQ signal detection block, measuring the vector error associated with the or each transmission link and forwarding the vector error information for transmission to a transmitting unit for the relevant transmission link.

38. A receiving unit according to claim 34 wherein the IQ signal detection block additionally comprises a third arm and the switching

switches the output from the IQ demodulator through one of the three arms depending on the payload modulation scheme recovered from the header and the first arm is arranged to detect 64-QAM signals, the second arm arranged to detect 16-QAM signals and the third arm is arranged to detect 4-QAM signals.

39. A transmitting unit for transmitting signals over at least one transmission link, which signals carry blocks of data wherein the transmitting unit comprises:

a database for storing modulation schemes which generate an optimum data rate at a predetermined bit error rate and symbol rate for different quality transmission links;

a processor for interrogating the database and allocating a modulation scheme to the blocks of data to be transmitted dependent on the quality of the transmission link;

an IQ signal generation means comprising:

a first arm for generating an IQ signal for a first modulation scheme;

a second arm for detecting an IQ signal for a second modulation scheme; and

switching means for switching data through one or the other of the arms dependent on the modulation scheme allocated to the data.

40. A transmitting unit according to claim 39 wherein the database stores sets of modulation and forward error rate coding level pairs which generate an optimum data rate at a predetermined bit error rate and symbol rate for different quality transmission links and the processor allocates a forward error correction level to the blocks of data to be transmitted dependent on the quality of the transmission link and the transmitting unit additionally comprises a forward error correction coding

means for applying the allocated level of error correction coding to the data blocks before the data blocks are input into the IQ signal generation means.

41. A transmitting unit according to claim 39 wherein the IQ signal generation block additionally comprises a third arm and the switching mean switches the data blocks through one of the three arms depending on the modulation scheme allocated to the data block and the first arm is arranged to generate 64-QAM IQ signals, the second arm arranged to generate 16-QAM IQ signals and the third arm is arranged to generate 4-QAM IQ signals.

42. A transmitting unit according to claim 39 additionally comprising an IQ modulator for modulating the output from the IQ signal generation block to generate and intermediate frequency signal, an upconverter means for upconverting the intermediate frequency signal to a radio frequency signal and a transmitting antenna for transmitting the radio frequency signal over the transmission link.

43. A transmitting unit according to claim 39 wherein the processor determines an optimum power for the transmission links depending on the level of traffic on the links and generates a power control signal and the unit additionally comprises:

an IQ modulator for modulating the output from the IQ signal generation block to generate and intermediate frequency signal;

an upconverter means for upconverting the intermediate frequency signal to a radio frequency signal;

an amplifier means for amplifying the radio frequency signal responsive to the power control signal; and

a transmitting antenna for transmitting the radio frequency signal over the transmission link.

44. A radio frequency signal IQ modulated with blocks of data wherein a block of data comprises a header and a payload and the payload is modulated according to an IQ modulation scheme with a higher spectral efficiency than the header.

45. A radio frequency signal according to claim 44 wherein the header is modulated according to a QPSK modulation scheme and the payload is modulated according to a 16-QAM modulation scheme.

46. A radio frequency signal according to claim 44 wherein the header is modulated according to a QPSK modulation scheme and the payload is modulated according to a 64-QAM modulation scheme.

47. A method of operating a cellular radio communication system for transmitting blocks of data over transmission links, comprising the steps of:

storing sets of modulation scheme and forward error correction coding level pairs which give an optimum data rate at a predetermined bit error rate and a predetermined symbol rate for different quality transmission links;
monitoring the quality of a transmission link;
interrogating the database and allocating a modulation scheme and forward error correction coding level pair to the blocks of data transmitted over the link dependent on the monitored quality of the transmission link; and
applying the allocated modulation scheme and forward error correction coding level to the blocks of data.

48. A method according to claim 47 wherein the modulation scheme can be selected from 64-QAM, 16-QAM and QPSK.

49. A method according to claim 47 wherein the forward error correction coding used is a BCH forward error correction code.

50. A method according to claim 47 wherein the transmission links are links between a plurality of end user terminals located within a cell and a base station located within the cell.

51. A method according to claim 47 comprising the additional step of storing a default modulation scheme suitable for the or each transmission link in poor environmental conditions for use when a call is initiated over the transmission link.

52. A method according to claim 47 wherein the transmission links are links between a plurality of end user terminals located within a cell and a base station located within the cell and the method comprising the additional step of storing a default modulation scheme for the transmission link to each end user terminal dependent on the distance between the end user terminal and the base station for use when a call is initiated over the transmission link.

53. A method according to claim 47 wherein the transmission links are links between a plurality of end user terminals located within a cell and a base station located within the cell and the method comprises the additional step of adjusting the power of the transmission links dependent on the level of traffic over the transmission links while maintaining the predetermined bit error rate.

54. A method according to claim 47 wherein the transmission links are links between a plurality of end user terminals located within a cell and a base station located within the cell and the method comprises the additional steps of:

increasing the level of forward error correction coding level above the allocated level to use the bandwidth of the transmission links; and

adjusting the power of the transmission links dependent on the change in the level of forward error correction coding level to maintain the predetermined bit error rate.

55. A method according to claim 47 wherein the transmission links are links between a plurality of end user terminals located within a cell and a base station located within the cell and the transmission links from the end user terminals to the base station comprise a common medium access uplink.

56. A method according to claim 47 wherein the transmission links are links between a plurality of end user terminals located within a cell and a base station located within the cell and the transmission links from the base station to the end user terminals comprise a broadcast downlink.

57. A method according to claim 47 wherein a block of data contains a payload and a header and the method comprises the steps of storing a default modulation scheme suitable for the or each transmission link in poor environmental conditions and allocating the default modulation scheme to the headers of the blocks of data for that transmission link.

58. A method according to claim 47 wherein the transmission link is from a base station to an end user terminal and the method comprises the additional steps of:

the end user terminal monitoring the quality of the transmission link received by it;

the end user terminal communicating the quality of the transmission link to the base station; and

the base station interrogating the database and allocating a modulation scheme and forward error correction coding pair depending on the quality of the transmission link.

59. A method according to claim 47 wherein the transmission link is from an end user terminal to a base station and the method comprises the additional steps of:

the base station monitoring the quality of the transmission link received by it;

the base station interrogating the database and allocating a modulation scheme and forward error correction coding pair depending on the quality of the transmission link; and

the base station communicating the allocated modulation scheme and forward error correction coding pair to the end user terminal.

60. A cellular radio communication system for transmitting data over transmission links, wherein different modulation scheme and forward error correction coding level pairs are dynamically allocated to the transmission links so as to give an optimum data rate at a predetermined bit error rate and a predetermined symbol rate.

61. A cellular radio communication system according to claim 60 wherein the different modulation scheme and forward error correction coding level pairs are dynamically allocated depending on the quality of the transmission links.

62. A cellular radio communication system according to claim 60 wherein the transmission links are links between a plurality of end user terminals located within a cell and a base station located within the cell.

63. A cellular radio communication system according to claim 60 wherein the system allocates a default modulation scheme for each transmission link for use when a call is initiated over the transmission link.

64. A cellular radio communication system according to claim 60 wherein the transmission links are links between a plurality of end user terminals and a base station and the system comprises means for adjusting the power of the transmission links dependent on the level of traffic over the transmission links while maintaining the predetermined bit error rate.

65. A cellular radio communication system according to claim 60 wherein the transmission links are links between a plurality of end user terminals and a base station and the system comprises:

means for increasing the level of forward error correction coding allocated to the transmission links so as to use all the bandwidth of the transmission links; and

means for adjusting the power of the transmission links dependent on the change in the level of forward error correction coding to maintain the predetermined bit error rate.

66. A cellular radio communication system according to claim 60 wherein a block of data comprises a header and a payload and a default modulation scheme is allocated to the headers of the blocks of data.

67. A cellular radio communication system according to claim 60 wherein the different modulation scheme and forward error correction coding level pairs are dynamically allocated depending on the quality of the transmission links and the quality of transmission links are periodically monitored.